Entergy

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Fred Dacimo
Site Vice President
Administration

September 13, 2006

Indian Point Unit No. 3
Docket No. 50-286
NL-06-084

Document Control Desk
U.S. Nuclear Regulatory Commission
Mail Stop O-P1-17
Washington, DC 20555-0001

Subject: Licensee Event Report # 2006-002-00, "Manual Reactor Trip as a Result of Arcing Under the Main Generator Between Scaffolding and Phase A&B of the Isophase Bus Housing"

Dear Sir:

The attached Licensee Event Report (LER) 2006-002-00 is the follow-up written report submitted in accordance with 10 CFR 50.73. This event is of the type defined in 10 CFR 50.73(a)(2)(iv)(A) for an event recorded in the Entergy corrective action process as Condition Report CR-IP3-2006-02255.

There are no commitments contained in this letter. Should you or your staff have any questions regarding this matter, please contact Mr. Patric W. Conroy, Manager, Licensing, Indian Point Energy Center at (914) 734-6668.

Sincerely,

Fred R. Dacimo
Site Vice President
Indian Point Energy Center

IE22

Attachment: LER-2006-002-00

cc:

Mr. Samuel J. Collins
Regional Administrator – Region I
U.S. Nuclear Regulatory Commission

U.S. Nuclear Regulatory Commission
Resident Inspector's Office
Resident Inspector Indian Point Unit 3

Mr. Paul Eddy
State of New York Public Service Commission

INPO Record Center

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES: 06/30/2007

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-I0202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE: Manual Reactor Trip as a Result of Arcing Under the Main Generator Between Scaffolding and Phase A&B of the Iso-phase Bus Housing

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV. NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
07	21	2006	2006 -	002 -	00	09	13	06	FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE

1

10. POWER LEVEL

100%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(A)(2)(I)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER *(Include Area Code)*
Jeff Nauditt, Maintenance Supervisor	(914) 734-6244

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

16. ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced type written lines)*

On July 21, 2006, at 1031 hours, Operations initiated a manual reactor trip (RT) as a result of observing arcing under the main turbine generator (MTG) between scaffolding and Phase A&B of the Iso-phase bus housing. All control rods fully inserted and all primary systems functioned properly. The plant was stabilized in hot standby with decay heat being removed by the main condenser. There was no radiation release. The Emergency Diesel Generators did not start as offsite power remained available. The Auxiliary Feedwater (AFW) system automatically started as expected due to a low steam generator (SG) level. The direct cause of the RT was due to arcing between metal scaffolding contacting two phases (A&B) of the Iso-phase bus housing. The root cause was latent Organizational/Programmatic weakness. There was insufficient awareness across the organization regarding the potential impact of leaving or removing conductive materials in close proximity to the MTG Iso-phase bus housing while the unit is in operation. Scaffolding left in place from a previous shutdown inadvertently came in contact with the MTG Iso-phase bus enclosure during scaffold disassembly. The operational risk of this condition was not adequately assessed. The scaffold procedure has no specification for addressing clearances for electrical safety hazards related to electromagnetic flux concerns. Corrective actions include coaching personnel on the event and lessons learned, preparation of an improved method in the work control process for screening operational risks, and revision of the scaffold procedure to include clearance criteria and precautions. The event had no effect on public health and safety.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

Note: The Energy Industry Identification System Codes are identified within brackets { }

DESCRIPTION OF EVENT

On July 21, 2006, at approximately 1031 hours, while at 100% steady state reactor power, Control Room (CR) {NA} Operators initiated a manual reactor trip (RT) {JC} in accordance with directions provided by the Operations Shift Manager (SM) as a result of observing arcing under the Main Turbine Generator (MTG) {TB} between metal scaffolding contacting two phases (Phase A&B) of the MTG Iso-phase bus {EL} {IPBU} housing. All control rods {AA} fully inserted and all primary systems functioned properly. The plant was stabilized in hot standby with decay heat being removed by the main condenser {SG}. There was no radiation release. The Emergency Diesel Generators {EK} did not start as offsite power remained available. The Auxiliary Feedwater System (AFWS) {BA} automatically started as expected due to a Steam Generator (SG) {AB} low level as a result of SG void fraction (shrink), which occurs after automatic RT from full load. On July 21, 2006, at 1416 hours, a 4-hour non-emergency notification was made to the NRC (Event Log # 42720) for an actuation of the reactor protection system {JC} while critical. The notification included an 8-hour notification for a valid actuation of the AFWS under 10 CFR 50.72(b)(3)(iv)(A). The event was recorded in the IPEC corrective action program (CAP) as CR-IP3-2006-02255. A post transient evaluation was initiated and completed on July 21, 2006, at approximately 1940 hours.

At approximately 1020 hours, the CR was contacted about a glowing scaffold plank. At approximately 1027 hours, the CR entered procedure 3-ONOP-FP-1, "Plant Fires," due to a report of a possible fire due to observed intermittent arcing and sparking on scaffolding in contact with, or under the influence of the MTG Iso-phase bus. The Operations SM went to the MTG to observe the condition and concluded the condition was unsafe and summoned the Fire Brigade and directed a RT. CR operators dispatched the Fire Brigade and initiated a RT. CR Operators entered procedure E-0, "Reactor Trip or Safety Injection," and upon completion of the immediate actions transitioned to ES-0.1, "Reactor Trip Response," at approximately 1035 hours. As a result of the RT, the following anomalies were noted; 1) the 31 reactor coolant pump {P} tripped on fast transfer (slow operation of fast transfer bus tie breaker UT1-ST5) {BKR}, 2) the 35 Nuclear Instrumentation (NI) {IG} indicated higher than expected, 3) Auxiliary Feedwater (AFW) flow to SG-33 was initially lower than flow to the SG-34 (flows were balanced manually), 4) initially the 33 SG level dropped lower than levels in the remaining 3 SGs, 5) radiation monitor R-14 spiked. Investigations were initiated to determine the cause of the event.

Investigations determined the following: as a result of a previous RT due to a main generator trip on July 6, 2006, scaffolding was erected under the generator to troubleshoot and repair degraded current transformer (CT) {XCT} wiring. The scaffolding met the requirements of the scaffolding procedure 0-SYS-014-GEN and the electrical safety procedure EN-IS-123. The scaffold was erected in accordance with the scaffold procedure but the procedure does not adequately specify electrical hazard clearances. The scaffolding and electrical safety procedures address standoff requirements for electrical conductors per OSHA but do not specify requirements for enclosed conductors with EMF potential such as the Iso-phase bus. After repairs, the plant was restarted on July 7, 2006, but the scaffolding was left in place for follow-up troubleshooting and monitoring. No operational risk assessment was performed on the scaffold being left in place.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

On July 21, 2006, at approximately 0745 hours, the scaffold crew received a pre-job brief, the Field Shift Supervisor (FSS) was notified of the start of work for scaffold removal, and the Work Order was taken from Ready to In-progress. At approximately 0900 hours, the scaffold crew accessed the bottom of the MTG and removed the smaller scaffold on the south side of the MTG without incident. At approximately 0930 hours, while workers were removing tie-wraps from metal scaffold planking, a scaffold worker noticed a blue electrical wave moving along the rear most plank closest to the Iso-phase bus. The scaffold workers immediately stopped work and notified their supervisor. The scaffold supervisor notified electricians who verified that the scaffold grounding was proper. At approximately 1015 hours, scaffold workers returned to work and smelled an unusual odor similar to welding. Upon removal of a second scaffold plank, workers observed that the scaffold plank was hot and glowing at the edge closest to the Iso-phase bus housing. Work was stopped, the scaffold supervisor was notified and he subsequently notified the CR. Both the unit 3 and unit 2 SMs investigated the condition. The SMs observed intermittent sparking and electrical arcing at the scaffold next to the Iso-phase bus housing. The unit 3 SM summoned the Fire Brigade and directed a reactor trip. An Engineering Supervisor who was a member of the responding Fire Brigade noted when the Brigade began removing scaffold planks, the plank where the sparks and glow were observed had to be pulled free as if it were attached or welded. Upon inspection, the burning of the "A" phase threaded rod and scaffold plank was evident.

The MTG has three isolated output buses (iso-phase bus) to transfer the three phase generator electrical output power to the Main and Unit Auxiliary Transformers {EL}. Each isolated bus (iso-phase) is a conductor (one for each of three phases) in a separate metal enclosure (bus housing) with an air space between enclosures that is connected to the bottom of the generator stator. The housings of the Iso-phase bus and cylindrical bus connectors are fabricated of aluminum with the bus connectors positioned in the center of the housing by a series of porcelain insulators. The outer shell housing of an Iso-phase bus duct circulates a current with opposite magnetic flux as the main bus conductors. The isolated phase bus is rated at 23kV and 32,000 amps.

An evaluation of the event determined that during disassembly of scaffolding under the MTG, portions of the scaffold came in contact with parts associated with the MTG CT support assembly, which is part of the MTG Iso-phase bus. The Iso-phase bus enclosure design is of the continuous type. This Iso-phase enclosure type is designed to minimize stray electromagnetic flux (EMF) which is generated by the high current flowing in the Iso-phase bus. Stray EMF will induce current flow and subsequent heating of supporting structures. The Iso-phase bus enclosure is designed, by its interconnection, supporting structure and grounding method, to preclude stray EMF and resulting induced current flow in the enclosure. The enclosure design reduces induced current flow because the induced currents flowing in the enclosure neutralize each other. However, if an alternate current flow path is established, then the induced current flow path is changed. This condition can cause a current flow in the alternate path. In this event, an alternate current flow path was created by the metal scaffold making contact with the Iso-phase bus enclosure. The contact between the scaffold and the Iso-phase bus structure was a high resistance contact causing contact points to heat up. An extent of condition review determined that the condition only applies to the Iso-phase bus for unit 2 and 3.

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

CAUSE OF EVENT

The direct cause of the RT was manual actuation based on operations observation of arcing between the MTG Iso-phase bus housing and scaffolding. The cause of the arcing was an alternate current flow to the metal scaffolding plank that had inadvertently made contact with two phases (A&B) of the MTG Iso-phase bus enclosure which had stray EMF induced current circulating in the outer housing. The root cause was a latent Organizational/Programmatic weakness, involving insufficient awareness across the organization regarding the potential impact of leaving or removing conductive materials (e.g., scaffold) in close proximity to the MTG Iso-phase bus housing while the unit is in operation.

This Organization/Programmatic weakness was also evident in the scaffold procedure (0-SYS-014-GEN) which does not contain information or instructions that could have prevented this event. The scaffold procedure has insufficient details for addressing electrical safety hazards related to electromagnetic flux concerns (EMF). Personnel also exhibited a lack of knowledge/awareness of the impact of leaving/removing scaffold prior to and during plant operations. There was evidence that the job scoping process did not identify special circumstances or conditions that may be impacted. The risk of leaving the scaffolding up during operation and its removal were not adequately assessed.

Three contributing causes (CC) were identified: CC1: There was a lack of technical knowledge and/or operating experience in key departments associated with scaffold removal and electrical anomalies near the MTG. CC2: There was less rigor associated with scaffold removal than during erection (pre-job briefs, plant awareness, management/supervisor oversight reduced). CC3: The scaffold procedure does not provide sufficient detail related to electrical hazards beyond addressing safety related plant equipment.

CORRECTIVE ACTIONS

The following corrective actions have been or will be performed under the CAP to address the causes of this event and prevent recurrence.

- The event was reviewed with scaffold crews and included in pre-job briefs.
- A Temporary Procedure Change (TPC) was issued to the scaffold procedure to provide minimum clearances and other precautions for scaffolding around the Iso-phase bus.
- An improved method for the work control process will be prepared for ensuring the performance of necessary screening and management of operational risk impacts for scaffolding maintenance determined to be a plant trip or personnel safety risk. Preparation of the method is scheduled to be completed by September 30, 2006.
- Appropriate personnel from Maintenance, Maintenance Support, Engineering, Operations, Planning Scheduling & Outage (PS&O) will be coached on the event and lessons learned. Coaching is scheduled to be completed by October 6, 2006.
- An assessment will be performed to identify site work areas of high EMF fields that may impact scaffold construction and as necessary caution/warning signs posted in the identified areas. The assessment is scheduled to be completed by November 30, 2006.

- The scaffold procedure 0-SYS-014-GEN will be reviewed for inclusion of adequate guidelines on clearances near electrical components with the potential for induced currents and shock and other electrical hazards and any necessary changes incorporated into the procedure. The procedure review is scheduled to be completed by October 20, 2006.
- The scaffold procedure 0-SYS-014-GEN will be revised to include the following: any additional necessary changes to address clearances for electrical hazards, precautions for building and removal of scaffolds around the MTG, a caution statement to review industry Operating Events (OEs) during pre-job briefs prior to installing or removing scaffold. The procedure revision is scheduled to be completed by November 30, 2006.
- The pre-job brief checklist will be enhanced to include criteria associated with scaffold removal. Pre-job briefs will be improved to include more rigorous discussions on scaffold removal. The pre-job brief checklist enhancement and the improvement of pre-job briefs is scheduled to be completed by October 20, 2006.
- An additional evaluation will be performed by an independent Engineering vendor of the electrical phenomena associated the Iso-phase bus and scaffolding which will be reviewed by Engineering with recommendations and corrective actions provided as necessary. The engineering review is scheduled to be completed by October 30, 2006.

EVENT ANALYSIS

The event is reportable under 10CFR50.73(a)(2)(iv)(A). The licensee shall report any event or condition that resulted in manual or automatic actuation of any of the systems listed under 10CFR50.73(a)(2)(iv)(B). Systems to which the requirements of 10CFR50.73(a)(2)(iv)(A) apply for this event include the reactor protection system (RPS) including RT, and the AFWS.

This event meets the reporting criteria because the RPS {JC} was actuated by manual operator action in response to a potential safety condition related to observed arcing under the MTG. The AFWS was actuated on a low SG level in response to the RT as a result of SG void fraction (shrink), which occurs after automatic RT from full load.

PAST SIMILAR EVENTS

A review of the past two years of Licensee Event Reports (LERs) was performed for events that involved a RT caused by inappropriate equipment conditions as a result of scaffolding. There were no unit 3 events identified that were similar. However, Unit 2 had an event reported in LER-2006-001 involving a RT due to scaffolding work. The event reported in IP-2 LER-2006-001 was a manual RT as a result of multiple rod drops that was caused by a loss of rod control power. Control rod power was lost due an inadvertent bump of the rod control power disconnect switch during scaffolding erection. The cause of the event for IP-2 LER-2006-001 was inadequate work practices and inadequate interface requirements. A ladder was not identified nor provided to perform the scaffold work and the worker violated his pre-job brief and climbed onto the power cabinet to perform work.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

Authorization to perform the work was not properly risk assessed because the computerized work flow process for scaffolding had been revised so that an operations planning review for risk was not required before scaffold work could be designated ready. This work flow process was in conflict with the work management process which specified that operations must review scaffolding work for risk prior to authorization of work. LER-2006-002 is similar to the event reported in IP-2 LER-2006-001 in that work with scaffolding impacted plant equipment and the risk was not adequately processed. However, the events were on different units although they both use the same work processes and scaffold procedures. The scaffold procedure (0SYS-014-GEN) does not adequately specify electrical hazards clearances for enclosed conductors with EMF potential such as the MTG nor include restrictions for EMF induced effects. The event reported for unit 2 in LER-2006-001 was different in that it was caused by a worker violating work practice whereas the event reported in unit 3 LER-2006-002 was performed in accordance with the procedure and work process. The risk of a trip was recognized in the event reported in IP-2 LER-2006-001 whereas the risk from the effects of the Iso-phase bus event was not understood.

SAFETY SIGNIFICANCE

This event had no effect on the health and safety of the public.
There were no actual safety consequences for the event because the event was an uncomplicated RT with no other transients or accidents. Required primary safety systems performed as designed when the RT was initiated. There were no risk related components out of service at the time of the RT. The AFWS actuation was an expected reaction as a result of low SG water level due to SG void fraction (shrink), which occurs after automatic RT from full load. Monitoring of the area verified there was no hydrogen leakage.

There were no significant potential safety consequences of this event under reasonable and credible alternative conditions. MTG Iso-phase arcing that could affect the MTG would have caused actuation of generator protection system (GPS) circuitry and resulted in a generator trip with a subsequent turbine and RT. The MTG is protected by the GPS which protects the MTG from internal and external faults by tripping the MTG output breakers. The GPS monitors various parameters and actuates the primary (86P) and backup (86U) lockout relays which initiate output breaker trip. Had a fault occurred on the Iso-phase bus the GPS would have tripped the MTG output breakers. For this event, rod control was in automatic and the reactor scrammed immediately upon RT. The redundant fail safe RPS initiated a RT as a result of a Turbine-Generator trip. The AFWS actuated and provided required FW flow to the SGs. Main Feedwater remained available as a heat sink water source. RCS pressure remained below the set point for pressurizer PORV or code safety valve operation and above the set point for automatic safety injection actuation. Following the RT, the plant was stabilized in hot standby.